IN THE CLAIMS:

1. (Once Amended) A fiber optic scintillator cell comprising:

a first component formed of scintillating material;

a second component formed of optically stimulated material; and

wherein the first component and the second component are arranged in a discretely layered stack.

Please cancel claim 3.

5. (Once Amended) The fiber optic scintillator cell of claim 4 wherein the scintillating material comprises material capable of absorbing electromagnetic energy and outputting optical emissions in response thereto and wherein the optical emissions cause the second component to output a signal having an intensity exceeding an intensity of the optical emissions received from the first component.

9. (Once Amended) A detector for a computed tomography system, the detector comprising:

a fiber optic scintillator configured to receive high frequency electromagnetic energy from a first direction having a first intensity and further configured to output light energy in a second direction generally parallel to the first direction having a second intensity, wherein the second intensity exceeds the first intensity; and

a photodiode coupled to the scintillator generally perpendicular to both the first and second directions and configured to detect the light energy output from the fiber optic scintillator.

15. (Once Amended) A CT system comprising:

a rotatable gantry having an opening to receive an object to be scanned;

a high frequency electromagnetic energy projection source configured to project a high frequency electromagnetic energy beam toward the object;

a scintillator array having a plurality of scintillator cells wherein each cell is configured to detect high frequency electromagnetic energy passing through the object, wherein each cell is configured to output light energy having an intensity exceeding an intensity of the high frequency electromagnetic energy detected by the cell;

a photodiode array optically coupled to the scintillator array and comprising a plurality of photodiodes configured to detect light output from a corresponding scintillator cell, wherein each photodiode outputs a signal indicative of the light output of the corresponding scintillator cell;

a data acquisition system (DAS) connected to the photodiode array and configured to receive the photodiode outputs; and

an image reconstructor connected to the DAS and configured to reconstruct a CT image of the object from the photodiode outputs received by the DAS.

23. (Once Amended) A method of manufacturing a fiber optic scintillator cell having optical gain, the method comprising the steps of:

fashioning a first component of scintillating material;

fashioning a second component of optically stimulated material; and one of:

intermixing the first component and the second component in a single composite structure, and

forming the first component in a single layer, forming the second component in a single layer, and connecting the first component layer and the second component layer to one another in a discretely layered structure.

Please cancel claims 26 and 27.

28. (New) A detector for a CT system, the detector comprising:

a pixilated array of scintillation elements arranged to receive x-rays emitted from an x-ray emitter toward a subject to be scanned, wherein each scintillator element includes a first component formed of scintillating material and a second component formed of optically stimulated material; and

a pixilated array of photodiodes coupled to receive light emissions from the pixilated array of scintillation elements such that each photodiode is configured to output a signal indicative of an intensity of light emitted by a corresponding scintillation element to a decoder.

29. (New) The detector of claim 28 wherein the scintillating material comprises material capable of absorbing electromagnetic energy and outputting optical emissions in response thereto and wherein the optical emissions cause the second component to output a signal having an intensity exceeding an intensity of the optical emissions received by the first component.

30. (New) The detector of claim 29 wherein the optical emissions output from the first component and received by the second component causes a cascading of multiple emissions from the optically stimulated material.

31. (New) The detector of claim 9 wherein the fiber optic scintillator and the photodiode are each a polyhedron.

REMARKS

In the Office Action of October 24, 2002, the Examiner rejected claim 1 under 35 U.S.C. §102(b) as being anticipated by Hoffman et al. (USP 6,087,665). Claims 1, 2, 4-7, 9, 10, 13, 14, and 23-27 were then rejected under 35 U.S.C. §102(e) as being anticipated by Gross et al. (USP 6,310,351 B1). Claims 1, 2, 4-7, 9, 10, 13-16, 19-21, and 23-27 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Hoffman (USP 6,115,448) in view of Gross et al. Claims 1, 2, 4-6, 8-10, 13-15, 17-21, and 23-27 were rejected under 35 U.S.C. §103(a) as being unpatentable over Eberhard et al. (USP

5,712,926) in view of Gross et al. The Examiner then rejected claims 3, 11, 12, and 22 under 35 U.S.C. §103(a) as being unpatentable over Hoffman '448 and Gross et al.

Regarding the rejection of claim 1 under 35 U.S.C. §102(b) and 35 U.S.C. §102(e), Applicant has amended the claim to incorporate the subject matter of claim 3. Claim 3 was not rejected under 35 U.S.C. §102, therefore, Applicant believes that claim 1 as amended herein defines the present invention over that which is disclosed by Hoffman et al. '665 and Gross et al. That is, neither Hoffman et al. '665 nor Gross et al. teach a fiber optic scintillator cell comprising a first component formed of scintillating material, a second component formed of optically stimulated material, and wherein the first component and the second component are arranged in a discretely layered stack. As such, Applicant believes that claim 1, as amended herein, is patentably distinct from that taught by Hoffman et al. '665 and Gross et al.

The Examiner rejected claim 9 under 35 U.S.C. §102(e) as being anticipated by Gross et al. Claim 9 is directed to a detector for a computed tomography system comprising a fiber optic scintillator configured to receive high frequency electromagnetic energy having a first intensity and further configured to output light energy having a second intensity, wherein the second intensity exceeds the first intensity. The detector further includes a photodiode optically coupled to the scintillator and configured to detect the light energy output from the fiber optic scintillator. The Examiner asserted the each of the aforementioned elements is disclosed by Gross et al. Applicant disagrees.

Gross et al. discloses a radiation detection device having a sensor component and an optical amplifier component which receives light converted by the sensor component, forwards it for further processing, and amplifies it at the same time. Abstract, '352. Gross et al. identifies that its radiation detection device is particularly applicable with MR tomography on the basis that implementation of standard electronic devices is undesirable because of the high static magnetic field, the time switched strong magnetic field gradients, the pulse incident electromagnetic waves in the MHz region, and the scarcity of available space for additional detection devices typically associated with MR tomography systems. Col. 1, lns. 52-61.

Gross et al. does not teach nor, as will be described in greater detail below, suggest a photodiode optically coupled to a scintillator and configured to detect light energy output from a fiber optic scintillator. The Examiner notes column 8, lines 14-15 of Gross et al. in support of the conclusion that the reference teaches the claimed photodiode. Gross et al. teaches that according to its invention "costly photo multipliers can be dispensed with" and "inexpensive PIN or avalanche diodes can be used due to the preamplification in the optical amplifier section." Col. 8, lns. 12-15. However, Gross et al. fails to provide guidance as to how the "inexpensive PIN or avalanche diodes" may be coupled to a scintillator or used therewith.

Further, the structural orientation called for in claim 9 is not possible with the radiation detection devices taught and disclosed by Gross et al. For example, in Fig. 4 of '352, Gross et al. teaches an incident x-ray beam that impinges on the "face" of crystal 20 whereupon light generated by the crystal is amplified and emitted out of a bottom surface of the crystal as illustrated by the downward facing arrows in Fig. 4. As such, the detection device taught by Gross et al. receives x-rays in one direction and outputs scintillation light in a second direction that is generally perpendicular or orthogonal to the direction of the x-ray path. Moreover, as illustrated in Fig. 4 of '352, any "photodiode" to be implemented with the device taught by Gross et al. would appear to have to be, at best, coupled to the bottom or lower surface of the crystal to receive the amplified light and, as such, would be oriented in such a manner as to be parallel to the impinging x-ray path.

In contrast, claim 9 as amended calls for a detector wherein a fiber optic scintillator is configured to receive high frequency electromagnetic energy from a first direction and output light energy in a second direction generally parallel to the first direction. The detector also includes a photodiode coupled to the scintillator and generally perpendicular to both the first and second directions and configured to detect the light energy output from the scintillator. The structural orientation called for in claim 9 cannot be achieved with the device taught by Gross et al. as the reference teaches a substantially different orientation than that which is claimed. As such, Applicant believes that claim 9 is patentably distinct from that taught by Gross et al.

Claim 23 was also rejected under 35 U.S.C. §102(e) as being anticipated by Gross et al. Applicant has amended claim 23 to further define the method of manufacturing a fiber optic scintillator such that the first component layer and the second component layer are connected to one another in a discretely layered structure. Applicant has also amended claim 23 to further define the scintillator cell as having a single layer of the first component of scintillating material and a single layer of the optically stimulated material. Gross et al. fails to disclose, or suggest, such a single layered structure.

Gross et al. teaches in each embodiment of its invention a fiber core in at least one jacket that surrounds the fiber core. As such, the fiber core described by Gross et al. is wholly self-contained within the disclosed jacket as a shroud. The jacket and core do not form a layered structure as is presently called for in claims 1 and 9. Further, nothing in Gross et al. suggests such an arrangement. Simply, Gross et al. teaches a tubular or concentric relationship and/or orientation – not a layered one. Additionally, in the embodiments of Figs. 2, 3, 4, and 5, Gross et al. teaches implementation of more than one jacket. As such, the radiation detection device disclosed by Gross et al. includes more than one layer of scintillating material and/or a non-discretely layered stacked structure. Accordingly, Applicant believes that which is called for in claims 1, 9, and 23 is patentably distinct from that disclosed by Gross et al.

The Examiner then rejected claims 1, 2, 4-7, 9, 10, 13-16, 19-21, and 23-27 under 35 U.S.C. §103(a) as being unpatentable over Hoffman '448 in view of Gross et al. Regarding claim 1, as indicated previously, Applicant has amended claim 1 to incorporate the subject matter of claim 3. Claim 3 was rejected under 35 U.S.C. §103(a) as being unpatentable over Hoffman '448 and Gross et al. The Examiner contends that "it would have been obvious to a person of ordinary skill in the art at the time the invention was made to couple the first component and the second component in a discrete layered stack, since a person would be motivated to design the shape and dimension of these components according to the engineering requirement." The Examiner further states that "in order to incorporate the scintillator cell disclosed by Gross et al. into the scintillator array in Hoffman's CT system, the components would necessarily have layered structures, with the second component (optically stimulated material) sandwiched

between the first component (the scintillator array) and the photodiode array." The Examiner draws this conclusion despite the references' failure to suggest such a combination.

Hoffman '448 is directed to a commonly known CT system similar to the CT system described and shown in Figs. 1-2 of the present application. Gross et al., however, is directed to an MR tomography system. Gross et al. identifies the advantages of its invention as not employing electronic detectors that may be adversely affected by the high static magnetic field, time switched strong magnetic field gradients, pulsed incident electromagnetic waves in the megahertz region, and scarcity of available space for additional detection devices commonly associated with MR tomography systems. Theses concerns, however, are not prevalent in CT systems as CT systems do not take advantage of the diagnostic benefits of high static magnetic fields and time switched strong magnetic field gradients typically associated with MR based systems. Accordingly, one skilled in the art of CT would not be motivated to combine the radiation detection device taught by Gross et al. with the known CT system described in Hoffman '448 because the avoidance of electronic detectors in a CT system is not paramount. Moreover, the CT system described by Hoffman '448 and similarly described in the present application makes full use of electronic detectors and photodiodes. As such, to incorporate the radiation detection devices taught by Gross et al. into such a CT system would violate the permissible implementations recognized by Gross et al. Simply put, one skilled in the art of CT would not be motivated to incorporate the radiation detection device taught by Gross et al. into the CT system described and taught by Hoffman '448. Further, even if combined, the result would not, could not, result in an arrangement as called for in amended claim 1. That is, such a combination would require a cutting and reshaping of the device taught by Gross et al. that the reference does not teach or suggest. The device taught by Gross et al. is tubular in nature wherein scintillating material completely shrouds the optically stimulated material. It is not possible to achieve the claimed arrangement based on the device taught or suggested by Gross et al. Therefore, Applicant respectfully believes that which is called for in claim 1, as amended herein, is neither taught nor suggested by Gross et al. or Hoffman '448.

Regarding the rejection of claim 9 under 35 U.S.C. §103(a), Applicant respectfully refers the Examiner to the remarks set forth above with respect to the §102 rejection of claim 9, as amended, and the remarks with respect to claim 1. Gross et al. fails to teach or suggest the structural orientation now called for in claim 9 and as such the rejection of claim 9 under 35 U.S.C. §103(a) is likewise not sustainable.

With regard to the rejection of claim 15 under 35 U.S. C. §103(a), Applicant respectfully refers the Examiner to the remarks set forth above with respect to the §103 rejection of claim 1. Claim 15 calls for a CT system that includes, in part, a scintillator array having a plurality of scintillator cells wherein each cell is configured to detect high frequency electromagnetic energy passing through the object, wherein each cell is configured to output light energy having an intensity exceeding an intensity of the high frequency electromagnetic energy detected by the cell, such that a CT image may be reconstructed. As stated above, Gross et al. teaches a radiation detection device applicable with MR tomography -- not CT. As such, one skilled in the art would not be motivated to combine the teachings of Gross et al. with Hoffman '448 to render the claimed CT system. Accordingly, Applicant requests withdrawal of the Examiner's rejection of claim 15 under 35 U.S.C. §103(a) as the references fail to teach or suggest that which is called for in claim 15.

Regarding the rejection of claim 23 as being unpatentable over Hoffman '448 in view of Gross et al., Applicant respectfully refers the Examiner to the remarks set forth above. Specifically, Gross et al. fails to teach or suggest a fiber optic scintillator cell comprising a single layer of scintillating material and a single layer of optically stimulated material coupled to one another in a discretely layered structure. Moreover, Gross et al. fails to teach or suggest a method of manufacturing such a scintillator cell. Further, there is no motivation or suggestion in Gross et al. or Hoffman '448 to incorporate the scintillator cell manufactured in accordance with the steps set forth in claim 23 into a CT system because, as noted previously, Gross et al. teaches a radiation detection device particularly applicable to MR tomography, not computed tomography. As such, Applicant believes that which is called for in claim 23 as amended herein is neither taught nor suggested by Hoffman '448 or Gross et al.

The Examiner also rejected claims 1, 2, 4-6, 8-10, 13-15, 17-21, and 23-27 under 35 U.S.C. §103(a) as being unpatentable over Eberhard et al. in view of Gross et al. Eberhard et al. is relied upon as it specifically teaches implementation of x-ray computed tomography for the detection of objects within a baggage or other parcel. Eberhard et al. also teaches implementation of its invention in a medical imaging environment. However, the purported combination of the teachings of Gross et al. with Eberhard et al. must also fail for similar reasons set forth above with respect to the combination of Hoffman '448 and Gross et al. Specifically, Gross et al. teaches a radiation detection device applicable with MR tomography, not computed x-ray tomography. Simply put, one skilled in the art would not be motivated to implement the detection device of Gross et al. into a CT system as the drawbacks overcome by the invention of Gross et al. are not found in CT systems; specifically, concerns regarding high static magnetic field and time switched strong magnetic field gradients. As such, Applicant respectfully believes that which is called for in claims 1, 2, 4-6, 8-10, 13-15, 17-21, and 23-27 is neither taught nor suggested by Eberhard et al. and/or Gross et al. Withdrawal of the rejection is therefore requested.

Claims 3, 11, 12, and 22 were also rejected under 35 U.S.C. §103(a) as being unpatentable over Hoffman '448 and Gross et al. as applied to claims 1, 9, and 19. With regard to the rejection of claim 3, Applicant respectfully refers the Examiner to the remarks set forth above as claim 3 has been cancelled herein and the subject matter thereof has been incorporated into claim 1. With regard to claims 11, 12, and 22, each of these claims depends from what is believed an otherwise allowable claim and therefore Applicant does not believe additional remarks are necessary. However, Applicant respectfully disagrees with the Examiner's application of the art with regard to the subject matter of these claims, but as a matter of brevity, Applicant will rely on the aforementioned argument for patentability of the subject matter called for in these claims.

Applicant requests entry and consideration of claims 28-31 newly presented herein to further define the present invention. Applicant believes that claims 28-31 are in condition for allowance as the subject matter called for therein is neither taught nor suggested by the art of record. Specifically, the references relied upon by the Examiner

fail to teach or suggest a detector for a CT system that includes a pixilated array of scintillation elements and a pixilated array of photodiodes coupled to receive light emissions from the pixilated array of scintillation elements. Each scintillation element includes a first component formed of scintillating material and a second component formed of optically stimulated material.

In light of the foregoing, Applicant respectfully believes that the present application is in condition for allowance. As a result, Applicant respectfully requests timely issuance of a Notice of Allowance for claims 1, 2, and 4-31.

Marked-up versions of the amendments made above may be found on pages 12 and 13.

Applicant hereby authorizes charging of deposit account no. 07-0845 in the amount of $18.00 for any additional fees associated with entering the aforementioned claims.

Applicant appreciates the Examiner's consideration of these Amendment and Remarks and cordially invites the Examiner to call the undersigned, should the Examiner consider any matters unresolved.

Respectfully submitted,

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